

Notes for AZ 2006/2008 IR 303(d) list review based on Feb. '07 draft

BLUE highlight suggests we could consider adding the water body to the 303(d) list. (Only @ is highlighted if based on older exceedences we would already have considered in the '04 review.)

PINK highlight shows water bodies where ADEQ specifically suggests EPA might add it to the list. However, ADEQ's 2nd submittal in January 2009 provides additional data on these water bodies and recommends that they NOT be listed.

GREEN highlight (far right column) is for water bodies ADEQ is proposing to newly add as impaired and/or to update the info based on ADEQ's 2nd submittal.

POLLUTANTS – DISSOLVED OXYGEN (DO), pH, Nitrogen (N)

Watershed	Water Body & segment ID (if multiple)	Pollutant	# of exceedences, comments. @ indicates we should further investigate the conclusion. Comment if DO values are particularly low.	Listed in '04? By EPA or ADEQ?	Did ADEQ propose to list for '06?
Bill W	Alamo Lake	DO, pH	DO – 9 of 60 pH – 10 of 60	Yes, for pH by ADEQ	Yes, for DO
Bill W	Big Sandy River – 004	DO	5 of 26 (19%); ADEQ discounts 1 due to storm flow and indicates that the remaining 4 exceedences were taken during low flow and lacked riffle morphology @	No	No
Bill W	Big Sandy River – 001	DO	2 of 4-5; discounted due to low flow and groundwater upwelling @	No	No
Bill W	Bill Williams River – 003	DO, pH	DO – 10 of 55 pH – 11 of 56	No	Yes, for DO & pH
Bill W	Bill Williams River – 001	DO	2 of (3-13?); discounted due to natural conditions of low flow & groundwater recharge @, 1 low value	No	No
Bill W	Boulder Creek – 005A	DO, pH	DO – 11 of 15; discounted for low flow & groundwater upwelling @, no values provided pH – 12 of 30	No	Yes, to 4B for pH
Bill W	Boulder Creek – 005C	DO, pH	DO - 1 of 13 (see comments for 005A) pH – 1 of 41	No	No
Bill W	Santa Maria River – 013	DO	1 of 2; discounted for natural conditions of low flow and ground water recharge	No	No
Bill W	Santa Maria River – 009	DO	5 of 28; ADEQ discounts 4 exceedences as taken during low flow conditions @	No	No
Bill W	Trout Creek	DO	1 of 23	No	No
Colorado -	Colorado River	DO	2 of 21	No	No

GC	– 001				
Colorado – GC	Dogtown Reservoir	DO, pH	DO - 1 of 4 pH – 1 of 4	No	No
Colorado – Lower Gila	Colorado River – 015	DO	4 of 23 (17%) @, values all above 6 for a 7 DO std.	No	No
Colorado – Lower Gila	Colorado River – 003	DO	2 of 18 (11%)	No	No
Colorado – Lower Gila	Colorado River – 001	DO	7 of 30 (23%)	No	Yes
Colorado – Lower Gila	Gila River	DO	4 of 22 (18%) @, relatively low DO values	No	No
Colorado – Lower Gila	Painted Rock Borrow Pit Lk	DO	2 of 5. Listed in 1992. (Dry or nearly dry since 2000.)	Yes, since '92	Yes
Little Colorado R	Ashurst Lake	DO	1 of 7	No	No
Little Colorado R	Barbershop Canyon Ck	DO	2 of 4; discounted due to low flow and groundwater upwelling. Flow of 0.01 cfs. Low nutrients.	No	No
Little Colorado R	Bear Canyon Lake	DO, pH	DO – 1 of 4 pH – 4 of (4-6?); low pH at 7-11.8 meters deep	Yes	Yes*
Little Colorado R	Billy Creek	DO	1 (or ??) of 8; discounted due to low flow and groundwater upwelling.	No	No
Little Colorado R	Black Canyon Lake	DO	3 of 8 (37%); @1 low value	No	No
Little Colorado R	Brown Creek	DO	1 of 2; discounted due to low flow and groundwater upwelling. Flow of 1.5 cfs. Low nutrients.	No	No
Little Colorado R	Bunch Reservoir	DO	2 of 3 @; values not that low.	No	No
Little Colorado R	Carnero Lake	DO, pH	DO – 1 of 5 pH – 2 of 6 (33%)	No	No
Little Colorado R	East Clear Ck	DO	2 of 4; discounted due to low flow (0.7-0.8 cfs) and groundwater upwelling	No	No
Little Colorado R	Fools Hollow Lake	DO	1 of 1; value close to std.	No	No
Little Colorado R	Hall Creek	DO	1 of 1; discounted due to low flow (0.1 cfs) and groundwater upwelling	No	No
Little Colorado R	Kinnikinick Lk	DO	1 of 10	No	No
Little Colorado R	Lake Mary (Lower)	DO pH	1 of 6 2 of 6 (33%)	No	No
Little Colorado R	Lake Mary (Upper)	DO	2 of 6 (33%)	No	No
Little Colorado R	Lee Valley Reservoir	DO, N	DO – 3 of 3; discounted due to groundwater upwelling	No	No

			N – 2 of 3 @; not exceeded by much		
Little Colorado R	Little Colorado River – 011	DO	1 of 19	No	No
Little Colorado R	Little Colorado River – 010	DO	1 of 30	No	No
Little Colorado R	Little Colorado River – 009	pH	1 of 24	No	No
Little Colorado R	Little Colorado River – 004	DO	3 of 17 (18%); values not low.	No	No
Little Colorado R	Long Lake (Lower)	pH	2 of 8 (25%) @	No	No
Little Colorado R	Lyman Reservoir	DO	1 of 4	No	No
Little Colorado R	Mineral Creek	DO	1 of 4; discounted due to low flow and groundwater upwelling. Low nutrients.	No	No
Little Colorado R	Nelson Reservoir	DO	1 of 4	No	No
Little Colorado R	Nutriosio Ck – 017A	DO	3 of 12; 1 discounted due to low flow and groundwater upwelling (0.1 cfs)	No	No
Little Colorado R	Porter Ck	DO	1 of 4; discounted due to low flow and groundwater upwelling (0.01 cfs)	No	No
Little Colorado R	Rainbow Lake	DO, pH	DO – 1 (or 2) of 3 pH – 2 of 3	Yes, by ADEQ in Category 4A	Yes
Little Colorado R	Show Low Creek	DO	1 of 4; low flow (0.5 cfs), groundwater upwelling	No	No
Little Colorado R	Silver Creek	DO	1 of 4; low flow, groundwater upwelling, low nutrients	No	No
Little Colorado R	Soldier's Lake	DO	2 of 5; values above 6.	No	No
Little Colorado R	Tunnel Reservoir	DO	1 of 2; value is 3.7.	No	No
Little Colorado R	West Fork Little Colorado River	DO	3 of 20-21; groundwater upwelling.	No	No
Little Colorado R	Willow Springs Lake	DO	2 of 4; values above 6.	No	No
Little Colorado R	Woods Canyon Lake	DO, pH	DO - 5 of 13; @ ADEQ states EPA is likely to add to 303(d) list. pH – 1 of 13	No	No
Middle Gila	Agua Fria River – 017	DO	2 of 4; 1 value at 1.7; low flow (0.01-0.05 cfs), groundwater upwelling; very low nutrient loads	No	No
Middle Gila	Arnett Creek	DO	2 of (4-6); low flow (0.01 cfs), groundwater upwelling	No	No
Middle	Cash Mine Ck	pH	1 of 2. Hassayampa River TMDL sets	No	No

Gila			loadings for metals.		
Middle Gila	Unnamed Trib to Cash Mine Creek	pH	1 of 1. Hassayampa River TMDL sets loadings for metals.	No	No
Middle Gila	Chaparral Park Lake	DO	No exceedences but listed in '04 for earlier exceedences.	Yes, by ADEQ	Yes
Middle Gila	Cortez Park Lake	DO, pH	No exceedences but listed in '04 for earlier DO and pH exceedences	Yes, by ADEQ	Yes
Middle Gila	Fain Lake	DO	1 of 3	No	No
Middle Gila	French Gulch	DO	2 of 10; 1 discounted for low flow and groundwater upwelling; TMDL in place for metals.	No	No
Middle Gila	Hassayampa River – 007A	DO, pH	DO – 3 of 41 pH – 7 of 13 Metals TMDL in place that would also address the pH problem (so TMDL for pH a low priority).	No	Yes, for pH
Middle Gila	Hassayampa River – 007B	DO	2 of many. Groundwater upwelling.	No	No
Middle Gila	Hassayampa River – 002A	DO	3 of 3. Low values. Discounted due to low flow (0.1 cfs) and groundwater upwelling. @	No	No
Middle Gila	Lake Pleasant	DO, pH	DO – 2 of 15. Std. = 6. Ex = 5.4, 4.6 pH – 1 of 15	No	No
Middle Gila	Martinez Canyon	DO	4 of 5; discounted due to low flow (0.01-0.05 cfs) and groundwater upwelling. @	No	No
Middle Gila	Mineral Creek	DO	29 of 218 samples. (13%) Cause unknown but be groundwater upwelling may be an issue.	No	Yes
Middle Gila	Queen Creek – 014B	DO	1 of 7	No	No
Middle Gila	Tempe Town Lake	DO, pH	DO – 6 of 280 (2%) pH – 2 of 890	No	No
Middle Gila	Turkey Creek – 036A	DO	1 of 7-9; low flow (.003 cfs), groundwater upwelling	No	No
Middle Gila	Turkey Creek – 036B	DO	1 of 20; low flow (.001 cfs), groundwater upwelling	No	No
Salt	Apache Lake	DO, pH, N	16 of 38 (or 9 of 17) pH – 2 of 15 N – 12 of 42 but not composite samples so the standard didn't apply @	No	Yes, for DO
Salt	Beaver Ck	DO	2 of 7; 1 discounted to low flow (.13), groundwater upwelling, low nutrients. The other, flood flow.	No	No

Salt	Canyon Lake	DO, N	DO - 10 of 23 (6 of 12 sampling events). N – 4 of 27 but not composite samples so standard didn't apply @	Yes, for DO by ADEQ	Yes, for DO
Salt	Christopher Ck	DO	7 of numerous; discounted for low flow (0.03-0.5 cfs) and groundwater upwelling. Marginally below std.	No	No
Salt	Crescent Lake	pH	1 of 3. EPA listed in '02 based on older data. No new data.	Yes, by ADEQ	Yes*
Salt	Ellis Ranch Tributary	pH	1 of 4	No	No
Salt	Gibson Mine Trib – 887	pH	8 of 10 sampling events. (80%). ADEQ is adding Cu to list. Binomial method cited. Note: this trib is being addressed by the Pinto Ck copper Phase II TMDL under development.	No	No
Salt	Hannagan Ck	DO	1 of 5-7; low flow (0.05 cfs), groundwater upwelling, low nutrients.	No	No
Salt	Mead Canyon	pH	1 of 2	No	No
Salt	Pinal Creek	DO, pH	DO – 10 of 109 (maybe); discounted for groundwater upwelling. @ pH – 1 of 63	No	No
Salt	Pinto Ck – 018A	pH	2 of 6. Pinto Creek Cu TMDL Phase II.	No	No
Salt	Pinto Ck – 018B	pH	4 of 28 (14%). Pinto Creek Cu TMDL Phase II.	No	No
Salt	Pinto Ck – 018C	DO	1 of 24 samples; low flow (0.05 cfs), groundwater upwelling, low nutrients	No	No
Salt	Roosevelet Lake	DO, pH, N	DO – 1 of 75 samples. pH – 2 of 79 samples. N – 12 of 89 samples in top meter. 6 of 23 samples at one site. Not composite so standard didn't apply. @	No	No
Salt	Rye Creek	DO	2 of 4; low flow (0.3-0.5 cfs), groundwater upwelling, low nutrients.	No	No
Salt	Saguaro Lake	DO, pH, N	DO – 5 of 19 (26%) at one site. 6 of 42 in top meter. @ ADEQ states EPA is likely to add to 303(d) list, Jason says this is due to releases from a dam, nothing a TMDL could change. pH – 2 of 19 N – 8 of 43. Not composite so std. didn't apply. @	No	No
Salt	Salt River - 004	DO	5 of 28 samples; low values. ADEQ attributes cause to a 2002 wildfire. 5 2004 samples had high DO.	No	No
Salt	Salt River –	DO	10 of 23 samples.	Yes, by	Yes

	003			ADEQ	
Salt	Stinky Creek	DO	1 of 2; discounted due to low flow (0.46 cfs), groundwater upwelling, low nutrients	No	No
Salt	Thomas Creek	DO	1 of 2; low flow (0.01 cfs), groundwater upwelling, low nutrients	No	No
Salt	Tonto Creek – 013A	DO, N	DO – 10 of 166. Groundwater upwelling may be primary cause but nutrient loading may contribute N – 1 annual mean in 2002. TMDL approved in '05.	Yes, by EPA for N and by ADEQ for DO	Yes (* for DO and N)
Salt	Tonto Creek – 013B	N	1 annual mean in 2002. 1 in 35 for single sample max. TMDL approved in '05.	Yes, now in Category 4A	Yes*
San Pedro	Bass Canyon Creek	DO	1 low value (in '04) out of 8. Low flow (0.1 cfs), low N and P.	No	No
San Pedro	Brewery Gulch	pH	1 of 6. EPA listed for Cu in '04. Cu to be addressed in Mule Gulch TMDL.	No	No
San Pedro	Buehman Canyon Ck	DO	2 of 10 samples; groundwater upwelling during very low flows	No	No
San Pedro	Double R Canyon Ck	DO	3 of 8-9 samples; discounted due to low flow (0.02-0.06 cfs) and groundwater upwelling @	No	No
San Pedro	Dubacher Canyon	pH	1 of 1. Very low value. Mule Gulch Cu TMDL will apply.	No	No
San Pedro	Grant Ck	DO	1 of 4 samples; low flow (0.09 cfs), groundwater upwelling, low nutrients	No	No
San Pedro	Leslie Ck	DO	2 of 2. Elevated nutrients for 1 exceedence. 2 nd exceedence attributed to low flow (0.03 cfs), groundwater, low nutrients.	No	No
San Pedro	Miller Canyon	DO	1 of 3-4 samples. Low flow (0.5 cfs) and groundwater upwelling.	No	No
San Pedro	Mule Gulch – 090B	pH	4 of 5. EPA listed in '02. Ongoing Cu TMDL will address low pH.	Yes, by EPA	Yes*
San Pedro	Mule Gulch – 090C	pH	3 of 8. Ongoing Cu TMDL.	Yes, by ADEQ	Yes
San Pedro	Mule Gulch – 090D	pH	1 of 1. Ongoing Cu TMDL.	No	No
San Pedro	Riggs Flat Lake	DO	1 of 1; groundwater upwelling, low nutrients	No	No
San Pedro	Rucker Canyon Creek	DO	2 of 7; low flow (.03-.07 cfs), groundwater upwelling, low nutrients	No	No
San Pedro	San Pedro River – 008	DO	2 of 68 samples; 1 due to low flow (.021 cfs).	No	No
San Pedro	San Pedro	DO	1 of 18. Flood flow with high N and P	No	No

	River – 011				
San Pedro	Spring Creek	pH	1 of 4	No	No
San Pedro	Turkey Creek	DO	1 of 4; low flow (0.1 cfs), groundwater upwelling, low nutrients	No	No
San Pedro	Ward Canyon	DO	1 of 4; low flow (0.1 cfs), groundwater upwelling, low nutrients	No	No
Santa Cruz	Alum Gulch – 561A	pH	2 of 2. TMDL done in '03.	Yes, by ADEQ as Category 4A	Yes
Santa Cruz	Alum Gulch – 561B	pH	1 of 1. TMDL done in '03.	Yes, by ADEQ as Category 4A	Yes
Santa Cruz	Arivaca Lake	DO	2 of 10 samples (1 of 7 sampling events).	No	No
Santa Cruz	Cienega Ck – 006A	DO	1 of 10-13; low flow (0.5 cfs), groundwater upwelling, low nutrients	No	No
Santa Cruz	Cienega Ck – 006B	DO	1 of 13-14; low flow (0.7 cfs), groundwater upwelling, low nutrients	No	No
Santa Cruz	Cox Gulch	pH	1 of 1. Low value. Three R Ck TMDL completed in '03.	Yes, by ADEQ as Category 4A	Yes
Santa Cruz	3 related tribs, incl Harshaw	pH	Three R Ck and Harshaw Ck TMDLs completed in '03	Yes, by ADEQ as Category 4A	Yes
Santa Cruz	Lakeside Lake	DO, pH	DO – 9 of 23 pH – 6 of 23 These exceedences are being addressed through an '05 nutrient TMDL.	Yes, by ADEQ as Category 4A	Yes
Santa Cruz	Loma Verde	DO	1 of 4, value = 2.2 in '02. *Very high nutrients of 15.2 N and 1.8 P. @ Check nutrients data.	No	No
Santa Cruz	Nogales Wash	DO	4 of 22 samples (18%). Binomial method cited. Listed for other pollutants. @ Mexico border issues.	No	No
Santa Cruz	Parker Canyon Ck	DO	2 of 2; low flow (0.2 cfs), groundwater upwelling, low nutrients	No	No
Santa Cruz	Parker Canyon Lake	DO	3 of 6, one of which is 2005. Std. = 7. 6.5, 5.1, 6.2. Binomial method cited. ADEQ took 4 composite samples since '05 that are well above (attaining) the DO std. Also included TP and TN data	No	No
Santa Cruz	Patagonia Lake	DO	1 of 4.	No	No
Santa Cruz	Pena Blanca Lake	DO, pH	DO – 1 of 8 sampling events. Low value. pH – 1 of 6 sampling events. High value.	No	No

Santa Cruz	Redrock Canyon	DO	1 of 4; low flows and groundwater upwelling, low nutrients	No	No
Santa Cruz	Rose Canyon Lake	pH	2 of 3 sampling events. (no new data since the '04 listing.)	Yes, by EPA in '04	Yes*
Santa Cruz	Sabino Canyon	DO	1 of 8-9 samples; low flow (0.01 cfs), groundwater upwelling	No	No
Santa Cruz	Santa Cruz River – 010	DO	3 of 15-17 samples from 2000; low flows (< 0.5 cfs), groundwater upwelling. No stream flow lately.	No	No
Santa Cruz	Santa Cruz River – 008B	pH	1 of 46 samples. Low value in 2000.	No	No
Santa Cruz	Sonoita Ck	DO	None noted but low DO measured below reach receiving Patagonia's WWTP discharge.	Yes, by ADEQ, Category 4B	Yes, now Category 5
Santa Cruz	Three R Canyon – 558B	pH	1 of 1 – low value in 2000. TMDL completed in '03.	Yes, by ADEQ as Category 4A	Yes
Santa Cruz	Three R Canyon – 558C	pH	None but TMDL in '03 applies.	Yes, by ADEQ as Category 4A	Yes
Upper Gila	Ash Creek	DO	1 of 6 samples; low flow (.004 cfs), groundwater source.	No	No
Upper Gila	Blue River – 026	DO	2 of 20.	No	No
Upper Gila	Campbell Blue River	DO	2 of 11-17 samples; low flow (< 0.5 cfs), groundwater upwelling	No	No
Upper Gila	Gila River – 001	DO	1 of 17 samples	No	No
Upper Gila	KP Creek	DO	1 of 7-9 samples; low flow (0.01 cfs), groundwater upwelling	No	No
Upper Gila	Luna Lake	DO, pH	DO – 5 of 11 at one site. pH – 5 of 11 at one site in upper meter. TMDL completed in 2000.	Yes, by ADEQ as Category 4A	Yes
Upper Gila	North Fork Cave Creek	DO	1 of 1-2; low flow (< 1 cfs), groundwater upwelling	No	No
Upper Gila	San Francisco River	DO	2 of 27 samples. Relatively stagnant pools.	No	No
Upper Gila	South Fork Cave Creek	DO	5 of 7-8; low flows (< 0.5 cfs), groundwater upwelling, low nutrients	No	No
Verde	East Verde River – 022A	DO	1 of 3 samples; likely due to groundwater upwelling/natural conditions.	No	No
Verde	East Verde River – 022C	DO	2 of 18-19 samples; natural conditions/low flows, groundwater upwelling	No	No
Verde	Granite Basin	DO,	DO – 1 of 5; natural conditions during	No	No

	Lake	pH	lake turnover. EPA removed from 303(d) list in '04. No new data. pH – 1 of 6.		
Verde	Granite Creek	DO	1 of 4 sampling events. EPA listed in '04 – elevated N at time of low DO; ADEQ notes that stream is intermittent and low DO may be due to groundwater upwelling or other natural conditions.	Yes, by EPA	Yes*
Verde	Horseshoe Reservoir	DO	1 of 1. Low value of 2.8.	No	No
Verde	Oak Creek – 019	DO	1 of 12 sampling events.	No	No
Verde	Oak Creek – 018A	DO	2 of 28 samples; low flow, groundwater upwelling, low nutrients	No	No
Verde	Pecks Lake	DO, pH	DO- 1 of 3 --value of 2.1 in 2000. pH – no exceedences shown. (High pH noted.) TMDL approved in 2000.	Yes, by ADEQ as Category 4A	Yes
Verde	Perkins Lake	DO	2 of 3 in 2001 in top meter of lake.	No	No
Verde	Roundtree Canyon Creek	DO	1 of 3-4; low flow (< 0.1 cfs), groundwater upwelling	No	No
Verde	Scholze Lake	DO	1 of 3 sampling events ('01 exceedence).	No	No
Verde	Sterling Canyon	DO	1 of 2-3; low flow, groundwater upwelling, low nutrients	No	No
Verde	Stoneman Lake	DO, pH	DO – no samples collected. pH - 1 of 2 in 2001. Natural condition due to lake evaporation cited. TMDL approved in 2000. (Lake dry for 3 years)	Yes, for pH by ADEQ as Category 4A	No (not a de-list but no water?)
Verde	Watson Lake	DO, pH, N	DO – 1 of 4 pH – 1 at several sites on 7/06/00. N – 3 of 6 EPA listed in '04 based on a fish kill. No new data.	Yes, by EPA	Yes*
Verde	West Fork Oak Creek	DO	1 of 4-7; low flow (0.5 cfs), groundwater upwelling, low nutrients	No	No
Verde	Whitehorse Lake	DO	1 of 11 samples in the top meter ('00-'02 timeframe). Value is 4.7. EPA listed in '04 based on 5 of 10 – ADEQ states that newer data does not show impairment.	Yes, by EPA	No, proposes for EPA to de-list
Verde	Willow Ck Reservoir	pH	1 of 2 samples.	No	No

* ADEQ has proposed to separately list this segment based on EPA's '04 list, as opposed to Arizona criteria.

Note: where ADEQ has specified # of sampling events, this is shown in the table. Where not specified, the total number of samples collected is shown (which may overestimate sampling events).

DISCUSSION

1. No clear pattern as to listing water bodies for DO exceedences. Most have few samples. Listings generally don't seem dependent on how much lower the value is below the standard (although Terry/Janet think this is a factor).
2. Clear connection made between low DO and high nutrient levels. Likewise, where nutrient levels are noted to be low, this implies that low DO values are not due to manmade sources but a function of natural conditions. Given this strong connection with nutrients, my impression is that in the future, ADEQ is counting on the newly proposed narrative nutrient standards for lakes and streams for a better assessment of nutrient impairment, which will in turn reveal whether low DO values are natural or not.
3. Most pH exceedences appear connected to copper impairments. In some cases water bodies listed for Cu are also listed for pH, in other cases they are not. No clear rhyme or reason. Where pH is not listed but copper is listed, ADEQ explains that pH levels will be addressed by a copper TMDL.

Question: does ADEQ expect us to add water bodies to the list for DO when multiple exceedences have been recorded and it's not a matter of low flow or groundwater upwelling? Is this more likely the case if it's a lake rather than a river or stream?

ADEQ notes on pg. 18 of its data interpretation and assessment criteria that where the source of flow is primarily groundwater upwelling, it is naturally low in DO (and typically flows at these sites are < 1 cfs). ADEQ says that, for naturally low DO to be the case, the assessment is to document that groundwater upwelling is the primary source of flow and nitrogen concentrations are < 0.5 mg/L and bacterial standards not exceeded.